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Falling Caesarean section rate and improving Intra-partum outcomes: A prospective cohort study

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Abstract

Objective: To evaluate Caesarean section (CS) rates and Moderate to severe Hypoxaemic Ischaemic Encephalopathy (HIE) rates with other core intra-partum outcomes following reconfiguration of maternity services in Cardiff, South Wales, UK.

Design: Cohort study of births 2006-2015.

Settings: A University tertiary referral centre for fetal and maternal medicine with 6000 births/year, University Hospital of Wales, UK.

Method: Data relating to births from 1st January 2006 to 31st December 2015 was extracted from the computerized maternity database on a yearly basis. Case notes of all mothers and babies for the same duration, were hand searched for documentation of HIE. HIE data was also collected prospectively by neonatologist (SC) and obstetrician (PA).

Main outcome measures: Incidence of caesarean section births, babies with moderate to severe HIE, Instrumental vaginal births, Obstetric Anal Sphincter Injuries (OASIS) associated with instrumental delivery, and major post partum haemorrhage (MPPH) of 2500ml or more.

Results: During this 10-year period, a downward trend in emergency CS rate was seen from 15.6% in 2006 to 10.5% in 2015, reducing total CS rate from 25.5% in 2006 to 21.2% in 2015. A downward trend in the incidence of moderate and severe HIE was seen over the same period. There was an increase in operative vaginal births (OVB) from 12.8% to 15%. The rate of Spontaneous Vaginal Births (SVB) remained stable. The incidence of OASIS remained constant and MPPH rate has fallen.

Conclusion: Following amalgamation of two medium sized obstetric units and the opening of a Midwifery Led Unit (MLU), core intrapartum outcomes have improved. Contributing factors are the introduction of regular multidisciplinary training with enhanced team working, compulsory education for obstetricians and midwives on cardiotocograph (CTG) interpretation, increased consultant presence on delivery suite, robust risk management systems and broad multidisciplinary agreement on clinical guidelines promoting vaginal birth

Key words: Caesarean section, Instrumental vaginal delivery, Hypoxaemic Ischaemic Encephalopathy, Obstetric Anal Sphincter Injuries, major post partum haemorrhage.

Introduction:

There has been a worrying trend in rising caesarean section (CS) rates in the UK and globally across the developed world. This has largely been attributed to the fear of litigation due to hypoxic birth injury to the baby, but despite this, there is no evidence that the incidence of hypoxic birth injury or other birth injuries to the mother or baby has fallen[1-2].

Following the amalgamation of two medium sized maternity units in July 2005 to one centralized unit for maternal and neonatal services, there was a commitment by all professionals working within the maternity service to initially stabilize, then to reduce the Caesarean section rate, whilst maintain safety for the mother and her baby. The maternity unit serves a large city population and in addition receives tertiary referrals for maternal and fetal medicine from across South Wales (population 2.5 million). Over this time period, the annual birth rate has remained stable at about 6000 births per year and five-core intra-partum outcomes were measured. In a 10-year period (1st January 2006 to 31st December 2015) the caesarean section rate (elective and emergency), incidence of moderate-severe hypoxaemic ischaemic encephalopathy (HIE), instrumental vaginal delivery rate (forceps and ventouse), rate of obstetric anal sphincter injury (OASIS) related to instrumental vaginal births and incidence of major post-partum haemorrhage (PPH) have been continuously collected.

This paper describes these outcomes and discusses the processes that may have led to the changes.

Methods:

Data was routinely collected as part of our local service evaluation and quality improvement programme and was therefore exempt from the need for ethical approval.

Data were obtained from the maternity database Protos, from 1st January 2006 to 8th July 2013. The maternity database Protos was replaced by a new database, Euroking on 9th July 2013, which has been used to record maternity outcomes since then. Data for elective and emergency Caesarean births, instrumental vaginal births, OASIS and PPH > 1000mL were continuously recorded on the University Health Board's Maternity Dashboard. Since 2010 the incidence of major PPH associated with transfusion of more than 4units of RBC and level 3 ICU admission has also been collected from data provided by blood bank records and the ICU data base ICNARC – (Intensive Care National Audit & Research Centre). Neonates who developed encephalopathy were prospectively identified from the national TOBY (Total Body Cooling) register since January 2005 and from a retrospective search for encephalopathy from discharge summaries from the neonatal unit. These were cross-referenced from maternity database records for "unexpected neonatal admissions at term". Each possible case of HIE was then fully investigated using the nursing and medical notes to ascertain if the neonate fulfilled the criteria for HIE as defined by McLennan[3] and the severity of HIE graded as per Sarnat and Sarnat criteria.[4] Infants with neuromuscular disorders and congenital abnormalities of the central nervous system were excluded. Data for HIE was interrupted in 2015 due to the full or partial closure of the level 3 neonatal cots for 30 weeks because of an outbreak of infection. Babies were transferred across the UK and it was not possible to verify the all the data. All other outcomes are reported consecutively.

Results:

Over the 10-year period (2006-2015), there were 60,522 births. The data is consecutive with no exclusions, so contains data from our own city population and the referrals and deliveries to the unit for fetal and maternal reasons.

Data shows that year on year, the Caesarean rate fell from 24.5% in 2006 to 21.2% in 2015 (Fig 1). Most of this change is attributed to the fall in the emergency caesarean section rate from 15.6% to 11%. This is largely due to a reduction in CS for 'non-reassuring fetal state' (NRFS) and a reduction in CS in the second stage of labour for fetal head malposition. The rate of elective CS has remained at around 10%. The instrumental vaginal birth rates have risen steadily over this period from 12.8% in 2006 to 15% and the rate of spontaneous vaginal birth has remained unchanged.

During the same time period, there has been a fall in the incidence of moderate and severe HIE. There were six babies diagnosed with either moderate or severe HIE in 2006 (1/1000 births) and since 2012, there has been one or two babies per year with this diagnosis making the incidence of moderate and severe HIE < 0.5/1000 births (Fig 2).

Other quality markers are presented in (Table 1). The incidence of OASIS associated with instrumental vaginal births has remained unchanged over the evaluation period indicating no increased maternal trauma associated with the rise in instrumental delivery rate. Massive haemorrhage (MPPH) as defined by the rate of PPH requiring >4 units of RBC and blood loss >2500mL has also fell. From 2010-2012, the rate was 5.9/1000. This had fallen to 4.3/1000 in 2014-15 with a marked reduction in the use of all blood products. The ICU

admission rates for PPH have reduced in line with these figures. In the 2 years 2005-06 there were 12 admissions to ICU for MPPH (1.2/1000 deliveries), 7 admissions in 2008-09, (0.56/1000 deliveries) and now there has an overall rate of 0.7/1000 deliveries since 2011.

Discussion:

In a large city hospital with a significant high risk workload for maternal and fetal medicine from across South Wales, there has been an overall fall in caesarean deliveries from 24.5% to 21.2% which is largely attributed to a fall in emergency caesarean sections 15.6% to 10.5%. At the same time, other quality and safety markers have remained unchanged or have also improved. The fall in the Caesarean rate equates to 1303 caesarean section births saved in our delivery unit over the last 10 years, if the CS rate had stayed at the same as that of 2006 rate of 24.5%. Most importantly the rate of moderate or severe HIE has also fallen and has remained at a very low level since 2012 less than 0.5/1000 births. This occurred at the same time as the UK national CS rates continued to increase, a trend also seen in our neighboring district maternity units. England statistics show an increase in caesarean birth to 26.2% and across Wales, NHS statistics 2012-13 recorded an average CS rate as 27.5%. These reports have also highlighted significant variation in CS rates from geographically

close maternity units.

The merger of two medium sized units in 2005 was associated with many changes in practice, including an increase in consultant obstetricians' and anaesthetic presence on the labour ward along with an increased number of senior midwives who coordinated the consultant delivery suite. A critical mass of senior obstetricians, anaesthetists and midwives are available 24 hours a day to enhance safety. Although consultants are not resident out of hours, there is a strong ethos of discussing decisions on the telephone and attending the labour ward should this be required. Fortnightly maternity risk management meetings were started with senior obstetric, anaesthetic and midwifery input. The meetings are open to all staff and this has improved learning from adverse clinical incidents through robust discussion and dissemination at clinical governance sessions, anonymized minutes with actions to all staff and training sessions. These discussions are applicable to both midwifery and consultant led care, allowing lessons to be learnt across all areas. Formal teaching sessions were introduced, including mandatory attendance at obstetric emergency scenarios and CTG teaching for all obstetric and midwifery staff. With these changes, there was increased direct supervision and training of trainee obstetricians, anesthetists and junior midwives.

The fall in Caesarean delivery has predominantly been due to a reduction in the number of emergency caesareans in labour for non-reassuring CTGs and an increase in forceps delivery in the second stage of labour for non-reassuring CTGs and delay with fetal head malposition. This has largely been achieved by improved CTG interpretation and direct daytime supervision of obstetric trainees learning forceps delivery.

ST Analysis (STAN) of Fetal ECG monitoring in labour was introduced in 2007. The

introduction of this adjunct technology to intrapartum fetal monitoring led to intensified training and teaching in fetal monitoring and increased knowledge and confidence in cardiotocography interpretation. This was shown in a staff survey in 2012. Introduction of STAN fetal monitoring led to a significant reduction in interventions such as fetal blood sampling in labour, which is well recognized, but also raised the profile of intra-partum care, minimising intervention and increased vigilant watchful monitoring during labour. The introduction of a central monitoring system in 2012, located in a comfortable clinical communal area, used by all staff, further enhanced this as wide ranging discussions about CTG abnormalities became possible away from the patient's bedside, reducing patient anxiety and improving decision making. Archived CTGs are stored electronically on the trusts server and can also be readily accessed from this room and all computers in the delivery unit. This has encouraged ad-hoc teaching sessions and general discussions around labour management.

Our fall in HIE is in contrast to the UK as a whole. Despite increasing CS births in the UK, the rate of moderate and severe intrapartum HIE has remained unchanged at 1/1000 births.[5,-7] The UK Confidential Enquiry into Stillbirths and Deaths in Infancy (1999) found that 50% of 567 of term babies investigated were possibly or probably preventable and involved poor CTG interpretation [6,7]. In the UK, awards for cerebral palsy during 2000-2010, due to cases judged preventable by better care totaled £ 1,263,581,324, which is 41% of all obstetric settlements.[7] Failures of the management of labour along with CTG interpretation were the most expensive payouts and are a potential area for improvement. A number of systematic reviews have demonstrated improvement in obstetric outcomes with regular training and teaching[8-10]. reduction in number of babies with low Apgar scores and babies with HIE has

also been shown as a result of regular multidisciplinary teaching in obstetrics[8]. Our data on HIE shows a fall to <0.5/1000 births in the last 4 years. We are aware that therapeutic cooling of the babies with moderate HIE improves their prognosis and reduces the severity of neurological deficit[11], however, therapeutic cooling does not seem to improve prognosis or outcomes of babies with severe HIE.

A rise in operative vaginal births has been seen in our unit over the evaluation period, mainly due to the rise in forceps births for fetal head malposition in 2nd stage of labour, which has corresponded to a fall in second stage CS. Kiellands forceps (KF) for management of fetal head malposition in 2nd stage of labour are used in our unit if an experienced operator is available. Cascade training from one consultant to another increased the number of senior obstetricians competent to undertake this mode of delivery and the number of trainees with experience in use of KF has likewise increased due to training through direct supervision. Alternatively, manual rotation is performed followed by Neville Barnes Forceps birth as recommended by the RCOG[12] and success in manual rotation has also increased over the same time period. Our rate of ventouse births has remained constant over 10 years. Patel and Murphy demonstrate that forceps deliveries are associated with fewer failures than vacuum extraction and are quicker, which may be of critical importance when there is presumed fetal distress[13].

The UK wide rise in CS rate corresponds with a decline in instrumental vaginal births[14]. These trends may be due to concerns over neonatal and maternal safety and lack of clinical skills in forceps delivery[14-17]. A reduction in instrumental delivery rate has occurred in the UK despite good evidence that the risk of severe obstetric morbidity increases significantly with emergency caesarean section in the second stage of labour[18-20]. Appropriate use of

instrumental delivery can reduce the risks and also the costs of obstetric care[21]. A UK based study found that although second stage caesarean section is sometimes appropriate, many could be prevented by the attendance of a more skilled obstetrician[21,22]. Shortening of obstetric training within the UK as a result of the European Working Time Directive has been highlighted and may have led to reduced opportunities for learning hands-on skills such as forceps delivery. Trainees are known to have a higher failure rate of instrumental deliveries compared to their consultant colleagues[22] and the authors also conclude that both the incidence and severity of maternal trauma are greater when an emergency CS is performed for failed instrumental delivery for failure to progress in labour. A survey by Gurney et al demonstrated that the rise in second stage CS in the UK is associated with poor training of trainee obstetricians[23]. Untrscheider et al found that 4.8% of all CS are performed in the 2nd stage of labour, the majority being nulliparous (76.5%), and in spontaneous labour (64%).[24] These authors concluded that 'there is a worrying rise in the overall rate of CS at full dilatation' and their strategies for improved care included increased consultant presence, meticulous documentation and ongoing training of junior obstetric staff.[25-28] Negative publicity around KF use has resulted in a dramatic reduction in their use in the UK with a parallel increase in the use of rotational ventouse and Emergency CS as alternative delivery methods[29].

We have found that with training and strict adherence to safe practice guidance, our increased rate of forceps and in particular rotational forceps has not had an adverse effect on neonatal or maternal morbidity. We are also reassured that 70-80% of these mothers will have a vaginal birth in their subsequent pregnancy and many are potentially eligible to give birth in a midwifery led setting.[30] There is increasing evidence that the health benefits of a

high CS rates are unclear in high-income countries.[26,27]

Although the fall in caesarean delivery is largely due to the fall in number of emergency caesareans, fifty-five CS are avoided each year because of a dedicated external cephalic version (ECV) service for breech presentation after 37 weeks' gestation. Although these are relatively small numbers, women who have had a vaginal birth after a successful ECV are highly likely to have another vaginal birth in their subsequent pregnancies; which may have a long term contribution to the falling CS rate.

One of the reported morbidities particularly associated with instrumental vaginal delivery is an increased incidence of OASIS. During this study period, the rate of this significant morbidity has been constant at around 3% (Fig. 1). Forceps birth has shown to be associated with an increased risk of a sphincter trauma with rates of up to 7% reported.[31] Our low rate of OASIS may be a consequence of training and supervision as recommended by the RCOG. It has been found that with appropriate training, the incidence of OASIS can be reduced, mainly by protection of the perineum during crowning of the baby's head.[32]

Morbidity around major PPH can reflect how effective the multidisciplinary team works on the delivery suite and how well guidelines are followed. The falling rate of very large bleeds, which leads to the majority of major maternal morbidities, is multifactorial. There have been noticeable improvements in the organisational aspects of managing MPPH particularly around communication with blood bank, the haematology laboratory, team members and portering. Other changes included strict adherence to obstetric intervention, guidance preventing the repeated use of ineffective therapies and earlier recognition of PPH with the routine weighing of pads and bedlinen to improved recognition of PPH. There is mandatory

attendance of an obstetrician, anaesthetist and midwife at a PPH of ≥1000mL, so obstetric interventions can be initiated before coagulation problems occur. The targeted use of coagulation products with the introduction of Point of Care coagulation testing may have further improved this important outcome.

Conclusion

The improvements in outcomes to mothers and babies of reducing emergency CS rates and reducing HIE rates at a large tertiary referral University City hospital has occurred gradually over 10 years. This achievement has been possible through the use of regular audits and quality improvement programs, review of clinical incidents with organizational learning, multidisciplinary training and a real commitment by all staff members to reduce emergency caesarean section rates. Our findings are important and play an important role in guiding and designing maternity services to deliver high-quality obstetric care.

This paper adds to the literature that in today's climate, it is possible to stabilize rising caesarean section rate with safe outcomes for mothers and their babies.

Disclosure of Interest

None

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None

Ethics

Data was routinely collected as part of our local service evaluation and quality improvement programme and was therefore exempt from the need for ethical approval

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Contribution to authorship

P.Amin: Primary author and responsible for conception and design.

S. Zaher: Draft revision

R. Penketh: Revision for intellectual content

S. Cherian: Revision for intellectual content

R. E. Collis: Substantial contribution to conception and design, acquisition of data and revision for intellectual content.

J. Sanders: Acquisition of data

K. Bhal: Revision for intellectual content.

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